DENTAL ARTICULATOR, METHOD FOR PRODUCING DENTURES AND METHOD FOR ADJUSTING THE ARTICULATOR IN OCCLUSION HEIGHT IN PREPARING THE DENTURES

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a dental articulator used in preparing a new denture from an existing denture. More particularly, the present invention relates to the structure of a dental articulator capable of preparing the new denture from the existing denture on the basis of features of a patient's jaw joint which is wide in allowance in relative movement between a lower jaw and an upper jaw of the patient,. wherein the new denture is free from any feeling of physical disorder even when it is new for the patient, wherein the dental articulator may reproduce the patient's dental arches in the patient's oral cavity, wherein the dental arches are precise in occlusion height in the oral cavity defined between the lower and the upper jaw and heretofore neatly fit to the patient in use. Further, the present invention relates to both a method for producing a new denture and a method for adjusting the occlusion height of the dental articulator in preparing the new denture from the existing denture.

2. Description of the Related Art

As shown in Fig. 16, a conventional dental articulator 1 (for example, such as one disclosed in Japanese Patent application Laid-Open No. Hei 9-206315) comprises: an upper frame 13 provided with an upper jaw model supporting portion 11 which is formed in a so-called "Frankfort plane", mounted on which supporting portion 11 is an upper jaw model 10; a lower frame 23 provided with both

a lower jaw model supporting portion 21 and a front end portion on which an incisal table 22 is mounted, mounted on which supporting portion 21 is a lower jaw model 20; a stand portion 30 for supporting both the upper frame 13 and the lower frame 23 in a manner such that a distance between the upper frame 13 and the lower frame 23 is adjustable by adjusting these frames 13, 23 independently of one other in position, which distance is hereinafter referred to as "occlusion height"; and, an incisal pin 14 which is mounted on the upper frame 13 so as to have its lower end portion disposed adjacent to an upper surface of the incisal table 22.

In the conventional dental articulator 1 having the above construction, the upper jaw model supporting portion 11 and the lower jaw model supporting portion 21 are detachably mounted on the upper frame 13 and the lower frame 23, respectively.

On the other hand, the dentures thus prepared become worn during daily mastication of meals. Consequently, it is necessary for the patient to replace the thus worn dentures with new ones every few years.

In preparing a new denture based on the patient's existing (i.e., old or worn) denture 50 by using the dental articulator 1, an old upper denture 51 has its border (i.e., peripheral portion) extended upward (as viewed in Fig. 1) to form a dam by the addition of is-compound material. Then, the old upper denture 51 provided with the dam in its border is returned to the patient oral cavity, so that the dam of the old upper denture 51 is brought into contact with the mucous membrane of the patient's oral cavity and deformed by the pressure of the membrane to become neatly fit to the patient's oral cavity. Hereinafter, a process step for forming and modifying in shape the dam of the modified old denture is referred to as a

"dam formation" step. The old upper denture 51 having been subjected to the "dam formation" step is then used as an upper dental tray 51. In use, the upper dental tray 51 thus prepared has its entire tissue side loaded with an impression material in order to obtain the impression of a mucous membrane of the patient's oral cavity when returned into the patient mouth. Likewise, an old lower denture 52 is modified in shape in a manner similar to the modification of the old upper denture 51 to become a modified old lower denture 52 capable of serving as a lower dental tray 52, as viewed in Fig. 1.

After the impression material loaded on the tissue side of the modified old upper denture 51 (which serves as the upper dental tray) has set or hardened, gypsum is poured in an oral cavity side of the modified old upper denture 51 to take the impression of the teeth and gum of the old upper denture 51. After the gypsum has set or hardened, the hardened gypsum is taken out of the old upper denture 51 to become an upper negative gypsum model of the teeth and gum of the modified old upper denture 51. Likewise, a lower negative gypsum model of the teeth and gum of the modified old lower denture 52 is made in a manner similar to the making of the upper negative gypsum model.

After that, a paraffin wax is poured into the upper and the lower negative gypsum model to produce an upper and a lower wax positive model, respectively.

The wax positive models having been softened by heating are then inserted into the patient's oral cavity and subjected to a so-called "occlusion confirmation" process in which the wax positive models are corrected in shape in occlusion action. In the thus corrected wax positives, now, their wax teeth are replaced with

pre-cast more rigid prosthetic teeth having been selected by the patient in type, size and shade, so that a so-called "occlusion bite pieces" are prepared. The occlusion bite pieces form pre-forms of the new dentures.

Added to the thus prepared pre-forms of the new dentures are gum portions to complete the pre-forms.

By using the thus completed pre-forms in a so-called "immersion process", negative molds of the new dentures are prepared. More specifically, the substitution of a suitable resin material for the wax gum portion of each of the completed pre-forms is carried out by a conventional lost wax process known in the art (see, Jun Nishiura, "dental technique for a denture with a base, general denture version", I-Shi-Yaku Shutzpan Kabushiki Kaisha, May 20, 1976, pp. 33-112).

Problems to be solved by the present invention will be now described.

In the conventional method for producing the new denture, however, there is no standard in occlusion height (i.e., precise height in occlusion) in the oral cavity in conducting the so-called "occlusion confirmation" process in which the wax positive models are corrected in shape during the occlusion action. Heretofore, the occlusion height is determined by individual dentist's experience. This leads to frequent modifications of the new dentures in shape after delivered to the patients.

In other words, in the oral cavity side of the new denture, it is possible to utilize the information obtained from the old denture as to a dam formed in a border portion of the new denture. In contrast with this, in the tissue side of the new denture, it is not possible to utilize any information obtained from the old

denture as to the occlusion height in the patient's oral cavity. Further, since a new set of artificial teeth are embedded in the dental arch of the new denture, it is necessary for the patient to return many times for follow-up appointments in order to have the dentist reshape and reconfigure the new denture so that it seats properly in the patient's mouth and feels correct to the patient. Such multiple return visits to the dentist office are not only annoying to the paying customer (i.e., patient), but also cost the dentist time and money, reduce patient confidence in the dentist, and, occasionally, one losses the patient's patronage.

The old dentures are useful in preparing the new dentures since the old dentures have been used actually for a long period of time by the patient, and therefore have a plenty of helpful information as to the new dentures. Therefore, it is very important to utilize the information obtained from the old dentures in preparing the new ones.

As for the conventional dental articulator having the above construction, it is not possible for the conventional dental articulator to compensate for the amount of wear in the teeth portion of the old denture in setting the occlusion height in the patient's oral cavity between the upper jaw model and the lower jaw model. This makes it impossible to prepare the new dentures on the basis of the old dentures, particularly, their occlusion conditions. More particularly, in the conventional dental articulator, it is not possible to move the upper and the lower jaw model in parallel with each other when the incisal pin 14 is adjusted to compensate for the amount of wear of the old dentures. Further, the incisal pin 14 may adjust a distance between the upper and the lower jaw model in their front end portions only. Due to these facts, an occlusion

height (i.e., distance between the front end portions of the jaw models) is different from another occlusion height (i.e., distance between the rear end portions of the same jaw models) in the same patient mouth. This leads to improper occlusion state in the patient's oral cavity.

Further, in the conventional dental articulator, by adjusting its stand portion 30 in length, it is possible to adjust in distance between the upper frame 13 and the lower frame 23. However, since the amount of wear of the upper jaw model 10 is often different from that of the lower jaw model 20, it is not possible to set a proper occlusion height even when the stand portion 30 is adjusted in length. Due to this, it is not possible for the conventional dental articulator to properly set each of the upper jaw model 10 and the lower jaw model 20, i.e., not possible to reproduce the actual occlusion conditions of the upper jaw model 10 and the lower jaw model in the patient's mouth.

In other word, in the conventional dental articulator, the jaw joint is realized in motion only by means of the incisal pin 14 as to the occlusion height in the patient's oral cavity. However, the jaw joint is different from any other joints since the jaw joint permits both the upper jaw and the lower jaw to move independently of one other in every direction by approximately 4 mm at maximum. Consequently, the teeth of the dentures are worm in mastication of everyday meals and therefore reduce in height. Due to this, the jaw joint loses its tightness. The inventor of the present invention has found the fact that the teeth of the dentures are substantially evenly worn in the same horizontal plate. This finding leads to the conclusion that: in preparing a new denture from an existing or old denture, since the conventional dental articulator can't

conduct any balanced adjustment in occlusion height due to its utter lack of consideration regarding the jaw joint's freedom in motion, it is not possible to prepare any new denture excellent in occlusion state.

SUMMARY OF THE INVENTION

Under such circumstances, the present invention was made. Consequently, it is an object of the present invention to provide a dental articulator, a method for preparing a new denture from an existing denture and a method of adjusting the occlusion height, wherein the dental articulator is prepared in consideration of the features of the jaw joint, and permits the new denture to be excellent in occlusion condition, prepared in a short period of time and accurately reproduce the occlusion height in the patient's oral cavity.

In accordance with a first aspect of the present invention, the above object of the present invention is accomplished by providing:

A dental articulator comprising:

a plurality of circular plates (4) varying in thickness;

a lower frame (23) provided with a lower jaw model supporting portion (21) in its upper surface, wherein a lower jaw model (20) is detachably mounted on an upper surface of the lower jaw model supporting portion (21) through a selected one of the circular plates (40), wherein each of the circular plates (40) forms a height-control means;

a stand portion (30) disposed upright in a rear portion of the lower frame (23);

an upper frame (13) provided with an upper jaw model supporting portion (11) in its lower surface, the upper fame (13) being

articulately connected to the stand portion (30), wherein an upper jaw model (10) is detachably mounted on a lower surface of the upper jaw model supporting portion (11) through a selected one of the circular plates (40);

wherein a selected one of the circular plates (4) is interposed between a jaw model supporting portion (11, 21) and a circular planar stage (16, 24) to enable the lower jaw model (20) and the upper jaw model (10) to move independently of one other in height control without causing any inclination of the lower jaw model (20) and the upper jaw model (10).

In the dental articulator having the above construction, preferably the height-control means is constructed of a calibrated cylinder (43) slidably mounted in each of the frames (13, 23).

Further, preferably the height-control means is constructed of an adjusting shaft (31) disposed inside the stand portion (30).

In accordance with a second aspect of the present invention, the above object of the present invention is accomplished by providing:

A method for adjusting an occlusion height in preparing a new denture from an existing one by using a dental articulator provided with a mechanism for adjusting the occlusion height defined between an upper jaw model supporting portion and a lower jaw model supporting portion, wherein these supporting portions are adjustable in height independently of each other, and an upper jaw model and a lower jaw model are detachably mounted on the upper jaw model supporting portion and the lower jaw model supporting portion, respectively, the method comprising the steps of:

forming and modifying in shape a dam in a border portion of the existing denture, wherein the dam formed in the border portion

of the existing denture is brought into contact with a mucous membrane of a patient's oral cavity and thereby modified in shape by the contact with the mucous membrane so as to fit the membrane, wherein the existing denture provided with the dam thus formed and modified in shape in the border portion is referred to as the modified existing denture;

loading an impression material in a tissue side of the modified existing denture, wherein the impression material thus loaded is brought into detachable contact with the mucous membrane of the patient's oral cavity by the insertion in the oral cavity of the modified existing denture having been loaded with the impression material to obtain the impression of the oral cavity in the impression material of the modified existing denture, wherein the modified existing denture provided with the impression of the oral cavity is referred to as the impressed existing denture;

measuring the impressed existing denture in thickness in a plurality of portions thereof to determine an average thickness of the impressed existing denture;

pouring gypsum on an impression side of the impressed existing denture to permit the gypsum to be set or hardened, so that a dental stone negative mold of the impressed existing denture is obtained with respect to each of an upper and a lower existing denture;

mounting an occlusion planar plate (70) on the dental articulator (1), wherein the dental stone negative mold of the impressed upper existing denture is temporarily mounted on the occlusion planar plate (70) and has its impression side bonded to the upper jaw model supporting portion (11) by means of gypsum;

dismounting the occlusion planer plate (70) from the dental articulator (1), wherein the impressed upper existing denture having

been bonded to the upper jaw model supporting portion (11) is mated with the corresponding impressed lower existing denture to form them into a single unit by means of a band, wherein the single unit has the impression side of its impressed lower existing denture bonded to the lower jaw model supporting portion (21);

dismounting the impressed upper existing denture from the upper jaw model supporting portion (11) to form an upper dental stone negative mold of the upper impressed existing denture, wherein the impressed lower existing denture is dismounted from the lower jaw model supporting portion (23) to form a lower dental stone negative mold of the lower jaw model supporting portion (23); and

adjusting the occlusion height with reference to the average thickness of the impressed existing denture, wherein the adjustment is conducted by adjusting in level the upper jaw model supporting portion (11) and the lower jaw model supporting portion (21) independently of each other.

According to the methods of the present invention (one of which methods is for producing a new denture from an existing denture and the other for adjusting the occlusion height), it is possible to properly adjust the occlusion height by adjusting in lateral position both the upper and the lower jaw model independently of one other. Due to this, it is possible to determine each of the upper jaw model and the lower jaw model in lateral position on the basis of the corresponding occlusion height in the individual patient's oral cavity. This makes it possible to arrange the teeth of the new denture substantially in the same manner as that of the teeth of the existing denture. Due to this, it is possible for the new denture of the present invention to make the patient free from any feeling of physical disorder. Further, it is possible for the

new denture of the present invention to utilize all the helpful information of the existing denture. Therefore, it is possible for the present invention to make the new denture excellent in fitness, with which the patient is satisfied.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, advantages and features of the present invention will be more apparent from the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a perspective view of the first embodiment of the dental articulator of the present invention;

Fig. 2 is a side view of the dental articulator of the present invention shown in Fig. 1;

Fig. 3(a) is a plan view of a plurality of circular plates mounted on the dental articulator shown in Fig. 1;

Fig 3(b) is a side view of the circular plates shown in Fig. 3(a);

Fig. 4 is a side view of a second embodiment of the dental articulator of the present invention;

Fig. 5 is another side view of the second embodiment of the dental articulator of the present invention shown in Fig. 4;

Fig. 6 is a perspective view of a silicone bite piece provided with the occlusion pattern of the old denture;

Fig. 7 is a plan view of each of the old upper denture and the old lower denture each viewed from the interior of the patient's oral cavity after completion of reproduction of the patient's tooth pattern and gum outline;

Fig. 8 is a plan view of each of the old upper denture and

the old lower denture each viewed from the interior of the patient's oral cavity after completion of reproduction of the patient's tooth pattern and gum outline, illustrating the impression material applied to each of the old dentures shown in Fig. 7;

Fig. 9 is a side view of each of the old upper denture and the old lower denture both shown in Fig. 8, illustrating a gypsum material applied to the old dentures;

Fig. 10 is a perspective view of the dental articulator of the present invention shown in Fig. 1, illustrating the old upper denture fixedly mounted on the dental articulator;

Fig. 11(A) is a perspective view a bite member mounted on the dental articulator of the present invention shown in Fig. 1, illustrating a pattern of the old upper denture's dentition arch impressed in an upper planar surface of the bite member;

Fig. 11(B) is a rear view of the bite member shown in Fig. 11(A);

Fig. 12 is a perspective view of the dental articulator of the present invention shown in Fig. 1, illustrating the old upper denture and the old lower denture both fixedly mounted on the dental articulator;

Fig. 13 is a perspective view of the dental articulator of the present invention shown in Fig. 1, illustrating the upper jaw model and the lower jaw model both formed after removal of both the old upper denture and the old lower denture;

Fig. 14(a) is a side view of the dental articulator of the present invention shown in Fig. 1, illustrating the old dentures in adjusting the old dentures in occlusion height;

Fig. 14(b) is another side view of the dental articulator of the present invention shown in Fig. 1, illustrating the circular

plates in adjusting the occlusion height;

Fig. 15 is a side view of the second embodiment of the dental articulator shown in Fig. 5 in a condition in which the old dentures are removed from the articulator; and

Fig. 16 is a perspective view of the conventional dental articulator, illustrating its basic construction.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The best modes for carrying out the present invention will be described in detail using embodiments of the present invention with reference to the accompanying drawings.

Fig. 1 shows a first embodiment of a dental articulator 1 of the present invention, a side view of which articulator 1 is shown in Fig. 2. The articulator 1 is provided with a plurality of circular plates 40 each forming a height-control means.

As shown in Figs. 3(a) and 3(b), the circular plates 40 varies in thickness. More specifically, in this first embodiment, four different kinds of the planar plates 40 are employed.

In addition to these planar plates 40, the articulator 1 of the present invention comprises: a lower frame 23 provided with a lower jaw model supporting portion 21 in its upper surface, wherein a lower jaw model 20 is detachably mounted on an upper surface of the lower jaw model supporting portion 21 through a selected one of the circular plates 40; a pair of stand portions 30 both provided upright in a rear portion of the lower frame 23; and, an upper frame 13 provided with an upper jaw model supporting portion 11 in its lower surface, wherein the upper fame 13 is articulately connected to the stand portions 30, and an upper jaw model 10 is detachably mounted on a lower surface of the upper jaw model supporting portion

11 through a selected one of the circular plates 40.

As is clear from Fig. 1, each of the frames 13, 23 has a substantially T-shaped form as a whole, and the supporting portions 11, 21 thereof widened laterally and rounded in periphery.

On the other hand, an incisal pin 14 is slidably mounted in a front end portion of the upper frame 13 and fixed to the frame 13 by fastening a stop screw 15 provided therein. By loosening the stop screw 15, it is possible to adjust the incisal pin 14 in length between the under surface of the upper frame 13 and an upper surface of an incisal table 22, which is mounted on an upper surface of a front end portion of the lower frame 23 to abut against a lower end portion of the incisal pin 14 thus adjusted in length. Further, as will be described later in detail with respect the replacement of wax teeth of a modified existing denture with separate pre-cast artificial teeth, it is also possible to utterly dislodge the incisal pin 14 from the front end portion of the upper frame 13 in order to improve the articulator 1 in workability in the replacement of the wax teeth of the modified existing denture with the artificial teeth.

As shown in Fig. 2, the upper jaw model 10 and the lower jaw model 20 both described above are bonded to the upper jaw model supporting portion 11 and the lower jaw model supporting portion 21, respectively, by means of gypsum or like material. Such bonding process will described later in detail.

In the lower jaw model supporting portion 21, as shown in dotted lines, a stop screw 25 has its elongated threaded portion extended upward and thereby passed through a central portion of each of the lower jaw model supporting portion 21 and the circular plate in this order from the bottom of the supporting portion 21. As a result,

the threaded portion of the stop screw 15 is threadably engaged with a threaded hole 24a of a circular planar stage or mounting plate 24. Consequently, it is possible to fixedly mount the mounting plate 24 on the lower jaw model supporting portion 21 through the circular plate 40 by fastening the stop screw 15. Provided in an upper surface of the lower frame 23 are a pair of upright projections 26 each having a circular shape in cross section. These projections 26 are detachably engaged with a pair of lower surface's holes of the circular planar stage 24 in an insertion manner.

It is possible to adjust in height the circular planar stage 24 in the articulator 1 by selecting a desired one of the circular plates 40 shown in Figs. 3(a) and 3(b), wherein the thus selected one 40 is disposed between the circular planar stage 24 and the lower jaw model supporting portion 21 to set the height of the circular planar stage 24 at a desired level in the articulator 1. In other words, the lower jaw model supporting portion 21 provides a means for moving the lower jaw model 20 without inclining the model 20. More specifically, such means is essentially constructed of a plurality of different kinds of the circular plates 40 different from each other in thickness, as shown in Figs. 3(b). For example, a first one of the circular plates 40 may have a thickness of 0.5 mm; a second a thickness of 1.0 mm; a third a thickness of 2.0 mm; and, a fourth may have a thickness of 3.0 mm. Each of the circular plates 40 is provided with a central through-hole 41 its central portion, which through-hole 41 is passed through by the threaded portion of the stop screw 25. Therefore, as described above, it is possible to adjust the height of the lower jaw model supporting portion 21 (more specifically, an upper surface of the circular planer stage 24) by selecting a desired one among the circular plates

40.

Further, each of the circular plates 40 is provided with a pair of diametrically opposed through-holes 42, which serve as means for stabilizing the circular plate 40 when these through-holes 42 receive therein the corresponding projections 26 of the lower frame 23. It is clear that the thus engaged projections 26 of the lower frame 23 may prevent the corresponding circular plate 40 from rotating relative to the lower frame 23.

A similar means for moving the upper jaw model 10 without inclining the model 10 is also provided in the upper fame 13, and therefore has substantially the same construction as that of the means provided in the lower frame 23 just described in the above. In other words, in the upper jaw model supporting portion 11, such means is essentially constructed of a plurality of different kinds of the circular plates 40 different from each other in thickness, as shown in Figs. 3(b). Each of the circular plates 40 is provided with the central through-hole 41 in its central portion, which through-hole 41 is passed through by a threaded portion of a stop screw 17. Therefore, it is possible to adjust the height of the upper jaw model supporting portion 11 (more specifically, a lower surface of a circular planer stage 16) by selecting a desired one among the circular plates 40. As for the circular planer stage 16, this stage 16 is provided with a threaded blind hole 16a in its upper surface, as shown in dotted lines in Fig. 2. Threadably engaged with this threaded blind hole 16a is the threaded portion of the stop screw 17, which has the threaded portion thereof passed through both the upper frame 13 and the circular plate 40 from upside in this order and threadably engaged with the threaded blind hole 16a of the circular planar stage 16. Consequently, it is possible to

fixedly mount the circular planar stage 16 on the upper frame 13 through the circular plate 40 by fastening the stop screw 17.

Further, each of the circular plates 40 is provided with a pair of diametrically opposed through-holes 42, which serve as means for stabilizing the circular plate 40 when these through-holes 42 receive therein the corresponding upright projections 18 of the upper frame 13. It is clear that the thus engaged projections 18 of the upper frame 13 may prevent the corresponding circular plate 40 from rotating relative to the upper frame 13. As is clear from Fig. 2, the selected one of the circular plates 40 is interposed between the circular planer stage 16 and the lower surface of the upper frame 13.

On the other hand, the circular planar stages 16 and 24 are provided with a plurality of convex portions 16b and 24b in their exposed sides, respectively. Each of these convex portions 16b and 24b serves as a better connection means for gypsum, which will be described later.

Further, as already described above, the upper frame 13 and the lower frame 23 are provided with the upper jaw model supporting portions 11 and the lower jaw model supporting portion 21, respectively. As is clear from Fig. 1, each of these supporting portions 11, 21 is laterally widened and rounded in periphery, provided in which periphery at predetermined angular intervals are a plurality of notched portions 76 serving as means for facilitating the grip of the supporting portions 11, 21 when the upper and the lower jaw model are mounted on the articulator 1, which will be described later in detail.

In the articulator 1 of the present invention having the above construction, it is possible to adjust in height the lower jaw model

supporting portion 21 and the upper jaw model supporting portion 11 independently of one other. Further, it is also possible for the articulator 1 to move vertically the upper jaw model supporting portion 11 and the lower jaw model supporting portion 21 without any inclination relative to the upper frame 13 and the lower frame 23, respectively.

Fig. 4 shows a second embodiment of the articulator of the present invention. This second embodiment is different in construction of the height-control means from the first embodiment shown in Figs. 1 and 2.

Incidentally, as described above in connection with the first embodiment, the height-control means of the first embodiment is constructed of the circular plate 4.

On the other hand, in the second embodiment of the articulator of the present invention, the height-control means is constructed of a calibrated cylinder 43. In the lower frame 23, as is clear from Fig. 4, such calibrated cylinder 43 is vertically slidably mounted in the lower frame 23. In other words, the calibrated cylinder 43 passes through a through-hole of the lower frame 23 from under the lower frame 23 to have its upper end portion abut on a lower surface of the circular planar stage 24.

On the other hand, in the upper frame 13, likewise, another calibrated cylinder 43 is vertically slidably mounted in the upper frame 13. In other words, the calibrated cylinder 43 passes through a through-hole of the upper frame 13 from above the upper frame 13 to have its lower end portion abut on an upper surface of the circular planar stage 16. As is clear from Fig. 4, the calibrated cylinder 43 is provided with a vertical scale in its outer peripheral surface, and has its central through-hole threaded to form a central

threaded hole 44, as shown in dotted lines in Fig. 1.

In the upper frame 13, the central threaded hole 44 of the calibrated cylinder 43 receives therein the treaded portion of the stop screw 17 and is threadably engaged therewith. Likewise, in the lower frame 23, the central threaded hole 44 of the other calibrated cylinder 43 receives therein the threaded portion of the stop screw 25 and is threadably engaged therewith.

These stop screws 17 and 25 have their threaded and projected end portions threadably engaged with threaded holes 16a and 24a of the circular planar stages 16 and 24, respectively, so that the stop screws 17 and 25 are fixedly mounted on the corresponding circular planar stages 16 and 24, respectively.

On the other hand, as is clear from Fig. 4, a lateral screw member 45 is threadably engaged with a threaded through-hole (not shown) of a side portion of each of the upper frame 13 and the lower frame 23 to have its front end portion abut against a side peripheral portion of the calibrated cylinder 43. Consequently, when the lateral screw member 45 is fastened, it is possible to rigidly fix the calibrated cylinder 43 to each of the corresponding frames 13, 23. In other words, it is possible to control the calibrated cylinder 43 in its effective length in the articulator 1 by using the lateral screw member 43 without involving any inclination of each of the circular planar stages 16, 24. Due to this, it is possible for the articulator 1 to permit the circular planar stage 16 of the upper frame 13 to move vertically with out any inclination relative to the corresponding circular planar stage 24 of the lower frame 23.

As is clear from Fig. 4, the upright projections 18 and 26 are formed in the corresponding frames 13 and 23, respectively, to project inward in the articulator 1. More specifically, the

corresponding frames 13 and 23 are provided with blind holes 13a and 23a, respectively. Consequently, the corresponding upright projections 18 and 26 are fixedly mounted in these blind holes 13a and 23a, respectively. It is also possible to unite these upright projections 18 and 26 with the corresponding circular planar stages 16 and 24, respectively, as is in the case of the first embodiment shown in Figs. 1 and 2. In this case, the blind holes 13a and 23a are formed in the corresponding circular planar stages 16 and 24, respectively.

With the exception of the above construction, there is substantially no difference in construction between the first embodiment (shown in Fig. 1) and the second embodiment (shown in Fig. 4). Consequently, through these embodiments, like reference numerals or characters apply to similar parts.

As a result, in the articulator 1 of the present invention having the above construction, it is possible to readily know in position or height the circular planar stages 16, 24 relative to the corresponding frames 13, 23 by reading the scales of the calibrated cylinders 43 even when the circular planar stages 16, 24 is adjusted in height by loosing the corresponding lateral screw members 45.

The calibrated cylinder 43 may have any shape in cross section, for example such as a square shape, a triangular shape and the like. Essentially, the calibrated cylinder 43 is an elongated member capable of being fixed to the corresponding frame (13 or 23) by fastening the corresponding lateral screw members 45.

Fig. 5 shows a third embodiment of the articulator of the present invention. A height-control means of this third embodiment is different in construction from those of the fist and the second

embodiment.

In other words, in this third embodiment, as shown in Fig. 5, a pair of the stand portions 30 are disposed upright in a rear portion of the lower frame 23. Mounted on an upper surface of the lower frame 23 is the lower jaw model supporting portion 21 on which the lower jaw model 20 is detachably mounted.

In this third embodiment, the height-control means (such as the circular plates 40 in the first embodiment, and the calibrated cylinder 43 in the second embodiment) is constructed of an adjusting shaft 31. This shaft or height-control means 31 is disposed inside each of the stand portions 30 to have its lower portion and its upper portion threadably engaged with a lower stand 33 and an upper stand 35, respectively. A pair of dial members 34, 37 are threadably engaged with an intermediate threaded portion of the adjusting shaft 31. Due to this, it is possible for the dial members 34, 37 to move vertically relative to the adjusting shaft 31 when they 34, 37 are rotated relative to the shaft 31.

More specifically, when the dial member 34 disposed adjacent to an upper end portion of the lower stand 32 is rotated relative to the adjusting shaft 31, the shaft 31 is vertically moved relative to the lower stand 32. On the other hand, when the dial member 37 disposed adjacent to a lower end portion of the upper stand 35 is rotated relative to the adjusting shaft 31, the shaft 31 is vertically moved relative to the upper stand 35. Due to this, it is possible to adjust in height the upper jaw model supporting portion 16 and the lower jaw model supporting portion 21 independently of one other, whereby it is possible to move the upper jaw model 10 and the lower jaw model 20 in parallel with each other in the occlusion plate.

As shown in Fig. 5, the lower stand 32 and the upper stand

35 are provided with lateral threaded through-holes 33 and 36, respectively. When a lateral screw member (not shown) such as that 45 used in the second embodiment is threadably engaged with the threaded holes 33 and then fastened, it is possible to fix the lower stand 32 to the adjusting shaft 31. Likewise, another lateral screw member (not shown) such as that 45 used in the second embodiment is threadably engaged with the threaded holes 36 and then fastened, it is possible to fix the upper stand 35 to the adjusting shaft 31. Consequently, as is the case of the calibrated cylinder 43 used in the second embodiment shown in Fig. 4, the adjusting shaft 31 serves as the height-control means in the articulator of the present invention.

Further, in the third embodiment, as shown in Fig. 5, after completion of the height control of each of the lower stand 32 and the upper stand 35, an effective length of the incisal pin 14 is adjusted in a manner such that the upper frame 13 is disposed in parallel with the occlusion plane in a condition in which a lower end portion of the incisal pin 14 is brought into contact with an upper surface of the incisal table 22.

Consequently, in the third embodiment of the articulator having the above construction, it is possible to move the upper jaw model supporting portion 11 and the lower jaw model supporting portion 21 in parallel with each other in the occlusion plane by using the height-control means or adjusting shaft 31.

It is preferable to provide a vertical scale in an outer peripheral surface of the adjusting shaft 31 in order to facilitate the reading of the effective distance between the upper frame 13 and the lower frame 23.

Now, a process for preparing a new denture from an existing

or old denture 50 by using the articulator having the above construction will be described with reference to Figs. 6 to 14.

First of all, the old pair of dentures 50 are returned to a patient's mouth to determine, in consultation with the patient: an amount of height being increased in an upper old denture 51; and, an amount of height being reduced in a lower old denture 52. The thus determined amounts of height are recorded in a dental chart for the patient.

After that, in a condition in which the old dentures 50 are placed in the patient's mouth, a silicone-based material is loaded on a lower denture's teeth arch to keep it for approximately 60 seconds to permit the silicone-based material to be set or hardened. After the silicone-based material has set, as shown in Fig. 6, a silicone bite 55 which is a negative impression of the lower old denture 51 is obtained.

Then, as shown in Fig. 7, iso-compound material (or like material) 61 is applied to a border portion of the tissue side of the upper old denture 51 to form a dam in such border portion. After the formation of the dam in the tissue side, the old dentures 50 are returned to the patient's mouth or oral cavity to have the dam of the old upper denture 51 brought into contact with a mucous membrane of the upper jaw and modified thereby in shape so as to neatly fit the patient's oral cavity.

Then, as shown in Fig. 8, a sufficient amount of an impression material is loaded in the tissue side of the old upper denture 51 to return to the patient's mouth. In this case, the old upper denture 51 is used as a dental tray. As a result, the impression material thus loaded in the tissue side of the old upper denture 51 is brought into contact with the entire mucous membrane of the patient's upper

jaw and modified thereby in shape so as to entirely fit the patient's upper jaw or oral cavity. The impression material 62 thus modified in shape is shown in a shaded area in Fig. 8.

Likewise, a similar modification process of the old or existing denture in shape by using both the iso-compound material and the silicone-based impression material is also performed as to the lower old denture 52.

Next, a step for measuring the thus impressed old upper denture 51 in thickness in a plurality of portions thereof to determine an average thickness of the impressed old upper denture 51 is conducted. It is preferable to measure the thickness at least three different points, for example: points "A", "B" and "C" as to the old lower denture 52; and, points "D", "E" and "F" as to the old upper denture 51. Further, it is also preferable to record an average of measured thickness values (which range from 0.5 mm to 3.0 mm) in the dental chart for the patient.

Then, conducted subsequent to the above denture modification step is a step for pouring a dental stone material 63 such as anhydrite or super anhydrite on an impression side of each of the thus impressed existing denture 51, 52 to permit the dental stone material 63 to be set or hardened, so that a dental stone negative mold (shown in Fig. 9) of the impressed existing denture is obtained with respect to each of the upper old denture 51 and the lower existing or old denture 52.

In the articulator 1 of the present invention, it is necessary to dispose the circular plate 40 (which has a thickness of 3 mm, for example, and serves as a reference plane) between the lower jaw model supporting portion 11 and the upper jaw model supporting portion 13.

Conducted subsequent to the above dental stone impression step is a step for mounting an occlusion planar plate 70 on the dental articulator 1, wherein the dental stone negative mold of the impressed upper existing denture 51 is temporarily mounted on the occlusion planar plate 70 using a utility was and has its impression side bonded to the upper jaw model supporting portion 11 by means of gypsum 60 in a condition in which the lingual side of the upper old denture 51 is aligned with a center line of the occlusion plate 70 and gypsum 60 is applied to both the tissue side of the old upper denture 51 and the upper jaw model supporting portion 11. As a result, as shown in Fig. 10, the old upper denture thus modified and impressed is bonded to the articulator 1. In this case, the gypsum 60 is used as a bond to the upper jaw model supporting portion 11 in the articulator 1.

The occlusion plate 70 is provided with a leg portion 71 in its bottom. As shown in Fig. 11(b), the leg portion 71 is provided with a pair of threaded holes 71a, 71b through which the occlusion plate 70 is fixedly mounted on the articulator 1 when a pair of screws (not shown) passing through these threaded holes 71(a), 71(b) are threadably engaged with the lower jaw model supporting portion 21 and fastened. Further, it is also possible to telescopically adjust in height the leg portion 71 of the occlusion plate 70. Due to this, it is possible for the occlusion plate 70 to dispose a center plane of occlusion on the occlusion plate 70.

Conducted subsequent to the above step is a step for dismounting the occlusion planer plate 70 from the dental articulator 1, wherein the impressed upper existing denture 51 having been bonded to the upper jaw model supporting portion 11 is mated with the corresponding impressed lower existing denture 52 to form them into a single unit

by means of a band 75, wherein the single unit has the impression side of its impressed lower existing denture 51 bonded to the lower jaw model supporting portion 21. Incidentally, the band 75 fits to the notched portions 76 of the upper frame 13 and is therefore capable of firmly holding the single unit described above.

After the gypsum 60 applied to the upper old denture 51 thus impressed has set, the wax disposed on the occlusion plate 70 is removed. Then, an impression paper 72 is applied to an upper surface of the occlusion plate 70. Under such circumstances, as shown in Fig. 11(a), the impression of the dental arch of the upper old denture 51 is printed on the impression paper 72.

Conducted subsequent to the above step is a step for dismounting the impressed upper existing denture 51 from the upper jaw model supporting portion 11 to form an upper dental stone negative mold of the upper impressed existing denture, wherein the impressed lower existing denture 52 is dismounted from the lower jaw model supporting portion 23 to form a lower dental stone negative mold of the lower jaw model supporting portion 23.

Conducted subsequent to the above step is a step for adjusting the occlusion height with reference to the average thickness of each of the impressed existing dentures 51, 52 , wherein the adjustment is conducted by adjusting in level the upper jaw model supporting portion 11 and the lower jaw model supporting portion 21 independently of each other.

Incidentally, after removal of the occlusion plate 70, the circular plate 40 having a thickness of 3 mm is interposed between the lower jaw model supporting portion 21 and the lower frame 23, wherein the circular plate 40 serves as a reference plane.

In a method of the present invention for adjusting an occlusion

height in preparing a new denture from the existing one by using the articulator 1 provided with a mechanism for adjusting the occlusion height defined between the upper jaw model supporting portion 11 and the lower jaw model supporting portion 21, wherein these supporting portions 11, 21 are adjustable in height independently of each other, and the upper jaw model 10 and the lower jaw model 20 are detachably mounted on the upper jaw model supporting portion 11 and the lower jaw model supporting portion 21, respectively, the method comprises the steps of:

forming and modifying in shape a dam in a border portion of the existing denture, wherein the dam formed in the border portion of the existing denture is brought into contact with a mucous membrane of a patient's oral cavity and thereby modified in shape by the contact with the mucous membrane so as to fit the said oral cavity, wherein the existing denture provided with the dam thus formed and modified in shape in the border portion thereof is referred to as the modified existing denture;

loading an impression material in a tissue side of the modified existing denture, wherein the impression material thus loaded is brought into detachable contact with the mucous membrane of the patient's oral cavity by the insertion in the oral cavity of the modified existing denture having been loaded with the impression material to obtain the impression of the oral cavity in the impression material of the modified existing denture, wherein the modified existing denture provided with the impression of the oral cavity is referred to as the impressed existing denture;

measuring the impressed existing denture in thickness in a plurality of portions thereof to determine an average thickness of the impressed existing denture;

pouring gypsum on an impression side of the impressed existing denture to permit the gypsum to be set or hardened, so that a dental stone negative mold of the impressed existing denture is obtained with respect to each of an upper and a lower existing denture;

mounting an occlusion planar plate 70 on the dental articulator 1, wherein the dental stone negative mold of the impressed upper existing denture is temporarily mounted on the occlusion planar plate 70 and has its impression side bonded to the upper jaw model supporting portion 11 by means of gypsum;

dismounting the occlusion planer plate 70 from the dental articulator 1, wherein the impressed upper existing denture having been bonded to the upper jaw model supporting portion 11 is mated with the corresponding impressed lower existing denture to form them into a single unit by means of a band, wherein the single unit has the impression side of its impressed lower existing denture bonded to the lower jaw model supporting portion 21;

dismounting the impressed upper existing denture from the upper jaw model supporting portion 11 to form an upper dental stone negative mold of the upper impressed existing denture, wherein the impressed lower existing denture is dismounted from the lower jaw model supporting portion 23 to form a lower dental stone negative mold of the lower jaw model supporting portion 23; and

adjusting the occlusion height with reference to the average thickness of the impressed existing denture, wherein the adjustment is conducted by adjusting in level the upper jaw model supporting portion 11 and the lower jaw model supporting portion 21 independently of each other.

In effect, the articulator 1 of the present invention is characterized by the provision of the height-control means which

is capable of adjusting in height the lower jaw model and the upper jaw model independently of one other without causing any inclination of these models.

In preparing the new denture from the old or existing denture, since it is possible for the dental articulator of the present invention to readily adjust the horizontal position of each of the upper jaw model and the lower jaw model independently of each other, it is possible to readily determine the position of each of the upper jaw model and the lower jaw model in accordance with individual occlusion height. Further, it is also possible for the dental articulator of the present invention to utilize information such as dentition arch's information and like information of the old denture in preparing precisely a new comfortable denture in an easy manner.

Finally, the present application claims the Convention Priority based on Japanese Patent Application No. 2002-280015 filed on September 25, 2002, which is herein incorporated by reference.